PRELIMINARY NOTES ON ASIATIC–POLYNESIAN SPECIES OF ERYTHRINA

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In the course of my work on the American species of *Erythrina* it has been frequently necessary to consult the Asiatic-Polynesian species of the genus. Related species exist in both hemispheres. Many species have been described on the basis of cultivated plants of unknown origin and their disposition involved a search among the Old World species. Inasmuch as there appears to be no compact treatment of the Asiatic-Polynesian species, it seems desirable to publish at the present time preliminary notes which are designed to tie Asiatic-Polynesian species with the groups that are being treated in my forthcoming paper on the American species. Several species are here reduced to synonymy and one is described as new. I wish to extend my sincere thanks to Dr. A. C. Smith, Dr. E. D. Merrill and Dr. J. H. Barnhart for their helpful suggestions and their criticism of the manuscript.

KEY TO THE SPECIES-GROUPS

Keel petals separate and subequal to wings; seeds red; leaflets stellate-pubescent beneath ..... 1. Variegatae

Keel petals connate; seeds not red; leaflets not stellate-pubescent beneath.

Keel petals subequal to wings; pods seedless and indehiscent in the lower half ..... 2. Subumbrantes

Keel petals conspicuously longer than wings; pods bearing seeds throughout.

Standard long-stipitate, subrotund-rhombic; seeds opaque, umber to blackish with black markings ..... 3. Fuscae

Standard and seeds not as above.

Pods ligneous, not follicular; leaflets not ceriferous beneath ..... 4. Arborescentes

Pods chartaceous, follicular; leaflets ceriferous beneath ..... 5. Suberosae

SYNOPSIS OF THE SPECIES-GROUPS

*Keel petals separate,** subequal or somewhat shorter than wings, much shorter than (usually not more than 3/7 as long as) standard; calyx spathaceous; pods ligneous, slightly or deeply constricted between seeds; seeds

*Characters shown in italics do not occur in other species-groups unless noted.

red, scarlet or pale red; *rachises, pedicels,* and *leaflets* (at least on petiolules and costa beneath when young) *stellate-pubescent.* .....1. VARIEGATAE

Keel petals connate, at sutural margins straight or nearly so, subequal to wings, much shorter than (usually not more than 1/2 as long as) standard; calyx campanulate; *pods flat, seedless and indehiscent in their lower half,* not at all constricted between seeds; seeds dark brown. *2.* SUBUMBRANTES

Keel petals connate, at sutural margins much curved, longer (usually less than 1 1/3 times) than wings, shorter than (usually 1/2 to 2/3 as long as) standard; *standard long-stipitate, subrotund-rhombic;* calyx broadly campanulate; pods ligneous, slightly constricted between seeds; seeds opaque, umber to blackish, with black markings. .....3. FUSCAE

Keel petals connate, at sutural margins straight or nearly so, longer (usually 1 1/3–2 times) than wings, much shorter than (usually not more than 1/2 as long as) standard; calyx campanulate; pods ligneous, slightly constricted between seeds; seeds shiny, black; leaflets not ceriferous beneath. .....4. ARBORESCENTES

Keel petals connate, at sutural margins straight or nearly so, much longer (usually 2 1/2 times or more) than wings, shorter than (usually not more than 4/7 as long as) standard; calyx campanulate (subspathaceous in *E. stricta*); pods *follicular, chartaceous,* not at all or slightly constricted between seeds; seeds isabelline to dark brown or sooty; *leaflets ceriferous on both margins of veinlets beneath* or intricately reticulately ceriferous beneath. .....5. SUBEROSAE

1. VARIEGATAE

1. **Erythrina variegata** L. Herb. Amb. 10. 1754.

1a. **Erythrina variegata** L. var. **orientalis** (L.) Merrill, Interpr. Rumph. Herb. Amb. 276. 1917.

2. **Erythrina Parcellii** Bull, Gard. Chron. II. **2:** 392. 1874.

3. **Erythrina mysorensis** Gamble, Kew Bull. **1919:** 222. 1919.

4. **Erythrina rostrata** Ridl. Fl. Mal. Penins. **1:** 580. 1922.

5. **Erythrina Merrilliana** Krukoff, **sp. nov.**

6. **Erythrina euodiphylla** Hassk. Hort. Bogor. 178. 1858.

7. **Erythrina boninensis** Tuyama, Bot. Mag. Tokyo, **49:** 373. 1935.

8. **Erythrina tahitensis** Nadeaud, Enum. Pl. Tahiti, 80. 1873.

9. **Erythrina sandwicensis** Degener, Fl. Hawaii. **2:** Fam. 169c. 1932.

The first six species listed above appear to be very closely related; a careful study of them is much needed. The doubtful *E. rostrata* may prove to be a synonym, whereas at least *E. mysorensis* may be merely a related variety or a form of the common and widespread *E. variegata* var. *orientalis.*

The rediscovery of the very rare *E. tahitensis* in Tahiti seems to be

essential for ascertaining the nomenclatural status of the Hawaiian plant now known as *E. sandwicensis*. I have seen *Nadeaud 499* (type of *E. tahitensis*), deposited at Geneva. It consists of a single inflorescence with small flower buds, two flowers, one pod, one seed, and no leaflets. From this available material it is impossible to decide whether or not the plant is specifically distinct from the plant native to Hawaii.

Brass 5265 apparently represents a previously undescribed species of the group VARIEGATAE, and it is described here as new. Its unvariegated leaflets distinguish it from *E. variegata* and *E. Parcellii,* the pale red rather than greenish standard from *E. cuodiphylla,* supposedly endemic to Bali. From *E. variegata* var. *orientalis,* which is represented in collections available to me by approximately 60 specimens, it is immediately distinguished by its remarkable comparatively small (although 3–5-seeded!) ligneous submoniliform pods, deeply constricted between seeds, completely open and much twisted at maturity. The pods resemble those of unrelated American species such as *E. Berteroana* Urb., *E. Folkersii* Krukoff & Moldenke, and others, and are not at all like the pods of *E. variegata* var. *orientalis* nor of other species of the group. Mature seeds were not available. They are undoubtedly reddish and much smaller than those of *E. variegata* var. *orientalis*. The type of the new species differs from the latter plant in certain other details, such as the narrow standard and the apparently more persistent tomentum of rachises, pedicels, calyces and leaflets. However, these characters as a rule are not reliable in the genus and will have to be verified by additional collections.

Erythrina Merrilliana Krukoff, sp. nov.

Arbor sub anthesi foliata; laminis foliorum concoloribus viridibus (non variegatis!); calyce spathaceo; vexillo elliptico, incarnato (non viridiusculo!); alis carinam longitudine aequantibus; carina 2-petala, petalis alis subconformibus sed paullo latioribus et rotundioribus; legumine parvo ligneo, inter semina multo angustato, maturitate valde contorto, seminibus 3–5; *E. variegatae, E. Parcellii* et *E. cuodiphyllae* affinis, characteribus supra enumeratis facile distinguitur.

A large tree, leafy at anthesis; branchlets rather stout, densely pubescent with stellate deciduous hairs on younger parts; petioles 17.5–19.5 cm. long, densely pubescent with stellate hairs, at length glabrescent or glabrous; petiolules 4–6 mm. long, about 1.5 mm. in diam., pubescent as the petioles; leaflet blades chartaceous, densely pubescent, soon glabrescent especially on the upper surface; terminal leaflets broadly ovate-deltoid, 9.5–12 cm. long, 7.8–12 cm. broad, obtuse at apex, truncate to subcordate at base; costa prominulous above, prominent

beneath, the secondary veins 6–7 on each side; rachis about 21 cm. long, densely pubescent with stellate hairs, at length glabrescent at least proximally; pedicels 0.9–1 cm. long, about 1.5 mm. in diam., densely pubescent with stellate hairs; calyx membranaceous, spathaceous, opening almost to the base, the part opposite the cleft truncate and with five long (up to 5 mm.) spur-like teeth, the calyx about 28 mm. long and 11 mm. broad when stretched, pubescent as pedicels; standard pale red (ex Brass), elliptic-oblong, erect, about 6.5 cm. long and 1.5 cm. broad; wings obliquely obovate, 13–16 mm. long, 4.5–6 mm. broad; keel petals separate, obliquely obovate, 12–13 mm. long, 5.5–6.5 mm. broad; stamens subequal to standard; pistil usually slightly longer than stamens, the ovary and gynophore densely pubescent, the style glabrous; fruit pedicels about 12 mm. long and 2 mm. in diam.; old pods ligneous, deeply constricted between seeds (submoniliform), about 10.5 cm. long and 1.3 cm. broad, tapering below into a stipe 1.5–3 cm. long, terminated at apex by a very stiff acumination about 1.5 cm. long, densely pubescent with stellate hairs when young, at length glabrous, 3–5-seeded; mature seeds not seen.

Type: *L. J. Brass 5265,* collected October 14, 1933, in secondary forest on lower slopes, Mafulu, Central Division, British New Guinea, alt. 700 meters, and deposited in the Herbarium of the New York Botanical Garden.

The collector describes the plant as a thick-boled tree, 20 meters tall, with pale red flowers, shining brown channelled bark, and soft yellowish wood.

It is a pleasure to name this species in honor of Dr. E. D. Merrill, who has made a valuable contribution to our knowledge of the genus by straightening out the confused nomenclature of certain Asiatic species.

In the course of my work on the American species, I have noted two species supposedly American which are plainly synonymous with *E. variegata* var. *orientalis.* They are discussed below:

Erythrina variegata L. var. **orientalis** (L.) Merrill.

{*Erythrina divaricata* DC. Prodr. **2**: 414. 1825.
{*Chirocalyx divaricatus* Walp. Flora **36**: 148. 1853.
{*Corallodendron divaricatum* Kuntze, Rev. Gen. 172. 1891.

{*Erythrina spathacea* DC. Prodr. **2**: 412. 1825.
{*Chirocalyx Candollcanus* Walp. Flora **36**: 148. 1853.
{*Corallodendron spathaceum* Kuntze, Rev. Gen. 173. 1891.

Erythrina divaricata was based on one of Sessé & Mociño's plates, and was said to be a Mexican plant. The reference in the original description to "foliolis cordatis acutis" and certain details of leaflets, calyx,

standard, and stamens, as seen from the plate (Calq. Dess. *pl. 256.* 1874), indicate clearly that the species belongs with *E. variegata* var. *orientalis* rather than with *E. velutina* Willd., the only American species of *Erythrina* that has a spathaceous calyx. The actual specimen (*Sessé, Mociño, Castillo* et *Maldonado 3695*) that was available for examination supports the above disposal of *E. divaricata.* Neither *E. velutina* nor *E. variegata* var. *orientalis* are native to Mexico. The plate was obviously drawn from a cultivated plant, probably collected in the West Indies.

Erythrina spathacea was described from a plant from Santo Domingo. I have been able to examine the type, kindly sent to me from Geneva by Dr. B. P. G. Hochreutiner, and it obviously belongs with *E. variegata* var. *orientalis.* The characters which, according to DeCandolle, separate *E. spathacea* from *E. divaricata* and *E. indica* Lam. (= *E. variegata* var. *orientalis*) are of no consequence. *Erythrina variegata* var. *orientalis* is known to have been introduced to the Dominican Republic (Santo Domingo) long ago and to have escaped from cultivation.

In America the group VARIEGATAE is represented by *E. velutina,* one variety and one form. The group is quite distinct from all other American and Asiatic-Polynesian species groups, largely by virtue of its spathaceous calyx and separate and subequal keel petals.

2. SUBUMBRANTES

10. **Erythrina subumbrans** (Hassk.) Merrill, Phil. Jour. Sci. **5:** 113. 1910.

This species occupies an isolated position in the entire genus. Its most unusual pods, seedless and indehiscent in the lower half, are not found elsewhere in the genus, but occur in certain other genera of Leguminosae.

3. FUSCAE

11. **Erythrina fusca** Lour. Fl. Cochinch. 427. 1790.

Erythrina atrosanguinea Ridl. Jour. As. Soc. Straits Branch 59: 93. 1911.

This common and widespread Asiatic-Polynesian species and the equally common and widespread American *E. glauca* Willd. are closely related. The group is related to the American CRISTAE-GALLI, and appears to be less closely related to the American VERNAE and the Asiatic *Suberosae,* which have quite different follicular chartaceous pods.

In reply to my request for seeds of *E. atrosanguinea,* Dr. R. E. Holttum, Director of Botanic Gardens, Singapore, in his letter of Aug 27, 1937, wrote: "*E. atrosanguinea* Ridl. is *E. fusca* Lour.". *Herb. Bot. Gard. Singapore 348,* distributed as *E. atrosanguinea,* is certainly conspecific

with *E. fusca*. In the original description I find no characters which would distinguish it from the latter species. In his key Ridley refers to the calyx of *E. atrosanguinea* as "cup-shaped, entire" whereas the calyx of *E. ovalifolia* Roxb. (= *E. fusca* Lour.) is described by him as "2-lipped." This character is of no consequence; the calyx of *E. fusca* is often nearly entire at the margin but lacerate just before anthesis, being greatly stretched transversely, and becoming distinctly 2-lipped.

Erythrina Moelebei Viell.; Guill. & Beauv. Ann. Soc. Bot. Lyon **38:** 87. 1914, hyponym.

I have not seen "*60* in herb. Lugd." which is cited by Guillaumin & Beauvisage as the basis for *E. Moelebei*. *Vieillard Herb. de la Nouvelle Calédonie 381* collected at Döebo, Wagap, Gatope, 1861–67, and distributed as "*E. Moëlebei* Vieill." is plainly *E. fusca*.

4. ARBORESCENTES

12. **Erythrina arborescens** Roxb. Fl. Ind. **3:** 256. 1832.

In fruit characters this Indian-Chinese species approaches species of the groups FUSCAE and CRISTAE-GALLI. However, it differs notably in having keel petals thinly membranous with the sutural margins straight or nearly so, rather than thickly membranous with the sutural margins much curved. Its keel petals resemble those of SUBEROSAE, which, however, has follicular chartaceous pods.

A doubtful species, *Erythrina Moori* Tod. (Hort. Bot. Panorm. **2:** 7. *pl. 26*. 1879) was described on the basis of a cultivated plant of unknown origin and said to be probably from India. Examination of the original description and the plate establishes definitely the fact that it is an Asiatic rather than an American or African species. Examination of the type, if it exists, is necessary to check my conclusion that *Erythrina Moori* is probably conspecific with *E. arborescens*.

5. SUBEROSAE

13. **Erythrina suberosa** Roxb. Fl. Ind. **3:** 253. 1832.

14. **Erythrina glabrescens** R. N. Parker, Indian Forester **46:** 647. 1920.

15. **Erythrina microcarpa** Koorders & Valeton, Booms. van Java **2:** 61. 1895.

16. **Erythrina stipitata** Merrill, Phil. Jour. Sci. **5:** 112. 1910.

17. **Erythrina stricta** Roxb. Fl. Ind. **3:** 251. 1832.

18. **Erythrina resupinata** Roxb. Fl. Ind. **3:** 257. 1832.

This group is obviously related to the American VERNAE, the only other group that also has follicular chartaceous pods.

Erythrina stricta somewhat resembles species of the group VARIEGATAE in having a subspathaceous calyx. It is here placed with the SUBEROSAE, to the species of which it is manifestly closely related, on the basis of many other important characters, such as connate keel petals, which are much longer than wings, and follicular chartaceous pods. Its leaflets are ceriferous on both margins of veinlets beneath, as is the case with *E. suberosa* and *E. glabrescens*.

Erythrina resupinata is placed with the group on the basis of a description of its flowers. Its fruits are unknown to me.

The characters that separate *E. glabrescens* from *E. suberosa* seem hardly sufficient to maintain it as a distinct species. Probably it will best be reinstated as a variety under *E. suberosa*.

I find no record of a satisfactory disposal of the doubtful species, *Erythrina bisetosa* Griff. Notul. Pl. Asia. **4:** 441. 1854. The description seems to indicate that it falls into the group SUBEROSAE, but without seeing the type I am not in a position definitely to suggest its affinity.

PREVIOUS ARRANGEMENTS OF ERYTHRINA BY H. HARMS AND J. LOUIS

Of the five groups into which I place the Asiatic-Polynesian species, the group VARIEGATAE would fall into the section CHIROCALYX (Meissn.) as interpreted by Harms in Engl. & Drude, Veg. Erde **9**(3)[1]: 656–659. 1915; the other four groups would fall into the section EUERYTHRINA Harv. Harms made a valuable contribution to the knowledge of the genus by conveniently grouping all African species known at that time into four sections, largely on the basis of the nature of the calycinal limb. In considering the entire genus rather than merely the African species, I prefer, however, to group the species into two subgenera as proposed by J. Louis, Bull. Jard. Bot. Brux. **13:** 295–319. 1935, largely on the basis of the nature of the dehiscence of the calyx. I believe that Louis is quite correct in considering that the sections DICHILOCRASPEDON and DILOBOCHILUS were established by Harms on relatively unimportant characters and therefore should not be considered of equal rank with CHIROCALYX and EUERYTHRINA, which were proposed by Harvey, Fl. Cap. **2:** 236. 1861.

In Louis's arrangement, three purely African sections, namely MEROCRASPEDON Louis, DICHILOCRASPEDON Harms, and DILOBOCHILUS

Harms, belong with the subgenus CHIROCALYX. I estimate these sections to contain approximately 14, 4 and 2 species respectively.* In the same subgenus would fall a compact group referred to in this paper as VARIEGATAE, which consists of 9 Asiatic-Polynesian and 1 American species. I have not seen sufficient material of 3 Australian species, namely *E. vespertilio* Benth., *E. phlebocarpa* F. M. Bailey, and *E. insularis* F. M. Bailey. In characters of fruits and in having separate keel petals subequal to wings they are obviously related to VARIEGATAE. Without careful study of complete botanical specimens I cannot suggest their affinity with this group. It is possible that the recently described *E. rotundato-obovata* E. G. Baker will have to be placed in the same group. The author states that it is closely related to *E. indica* Lam. (= *E. variegata* L. var. *orientalis* [L.] Merrill). I have not seen specimens of this interesting species. The subgenus CHIROCALYX in Louis's interpretation, therefore, would consist of approximately 34 species.

With the subgenus EUERYTHRINA, as interpreted by Louis, would have to be placed the groups SUBUMBRANTES, FUSCAE, ARBORESCENTES, and SUBEROSAE, treated in the present paper and containing 1, 2, 1 and 6 species respectively, approximately 11 African species (largely subtropical), and all the American species with the single exception of *E. velutina* Willd. It is noteworthy that of the African species which fall into the subgenus EUERYTHRINA none are closely related to the Asiatic-Polynesian species. They cannot be placed in any of the Asiatic-Polynesian species-groups.

SUPPLEMENTARY NOTE

When this paper was in proof, I received through the courtesy of the officials of the Botanic Museum and Herbarium, Brisbane, the loan of their *Erythrina* material. These collections include the types of F. M. Bailey's species which are not represented in American herbaria.

Erythrina vespertilio Benth. in Mitch. Jour. Trop. Austr. 218. 1848.

This short-boled tree, often from 1 to 3 feet in diameter, is rather common along the coastal areas of southern Queensland and is usually referred to locally as "Grey Corkwood." The numerous collections of the species show extraordinary variations in form of leaflets, to which Bentham (Fl. Austr. **2**: 253. 1864) has already called attention. On the basis of the characters that were discussed by me under "Synopsis of the species-groups," the species falls with the VARIEGATAE.

*My estimate is doubtless conservative. I have not included in it several new species, all related to *E. abyssinica* Lam., which appear to have been segregated on dubious characters by E. G. Baker.

Erythrina insularis F. M. Bailey, Queensl. Agr. Jour. **1**: 228. 1897.

The species appears to be known only from two unmounted sheets of the type collection, *F. M. Bailey 29,* Turtle Island, June 1897. These consist of detached leaflets, petioles and fragments of branchlets, and of a single rachis with numerous pods and seeds. The original description covers well the available material. In the absence of flowers, on the basis of scarlet seeds and of stellate pubescence of petiolules, I place the species with the VARIEGATAE. It is noteworthy that its comparatively small ligneous submoniliform pods, which are deeply constricted between seeds and completely open and much twisted at maturity, resemble those of *E. Merrilliana* of the VARIEGATAE and of certain unrelated American species of the HERBACEAE. Its comparatively small scarlet seeds (9.5–11 mm. long and 7–8 mm. broad), with a broad black line extending for approximately 2 mm. toward the chalazal end, also resemble those of certain members of the HERBACEAE.

Erythrina phlebocarpa F. M. Bailey, Queensl. Agr. Jour. **1**: 368. 1897.

The type collection, *Frank L. Jardine s.n.,* Newcastle Bay, consists of three unmounted sheets with detached leaflets and petioles, and of one unmounted sheet with a single rachis, one pod and two seeds. With the species I place excellent sheets (in flower) of *C. T. White 9073,* from a tree 15 meters high, with bright deep red flowers, cultivated at the Botanic Gardens, Brisbane, and *C. T. White 10123* (in fruit), from a small tree with very smooth trunk and soft wood, beach on edge of light rain-forest, Hayman Island. The pods and seeds of the species cannot be distinguished from those of the common *E. variegata* var. *orientalis* and they were well covered in the original description. Its keel petals are connate, at sutural margins straight or nearly so, longer (usually less than 1⅓ times) than wings, much shorter than (usually not more than ½ as long as) standard, its calyx is campanulate and its leaflets are not ceriferous beneath. Thus it is obvious that the species cannot be placed with any of the five species-groups treated in my notes on Asiatic-Polynesian species and has to be segregated in a group of its own, which links with the ARBORESCENTES on the basis of flower characters and with the VARIEGATAE on fruit characters. It falls within the subgenus EUERYTHRINA Harv. as this is interpreted by J. Louis. The species is undoubtedly one of the most interesting members of the genus.

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